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iPhone 4s Case Family Design

The Ubiquitous iPhone

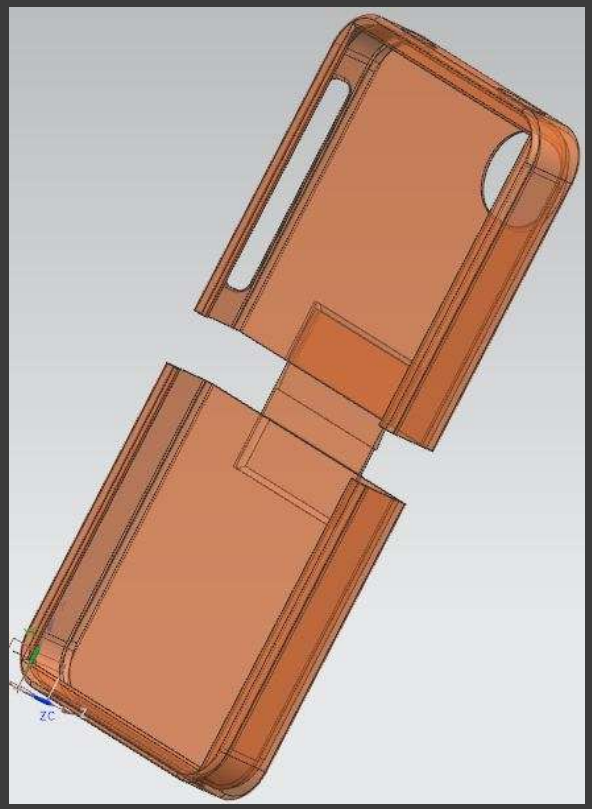
- Sold 1,000,000+ devices in less than 24 hours
- Fastest selling “iDevice” ever

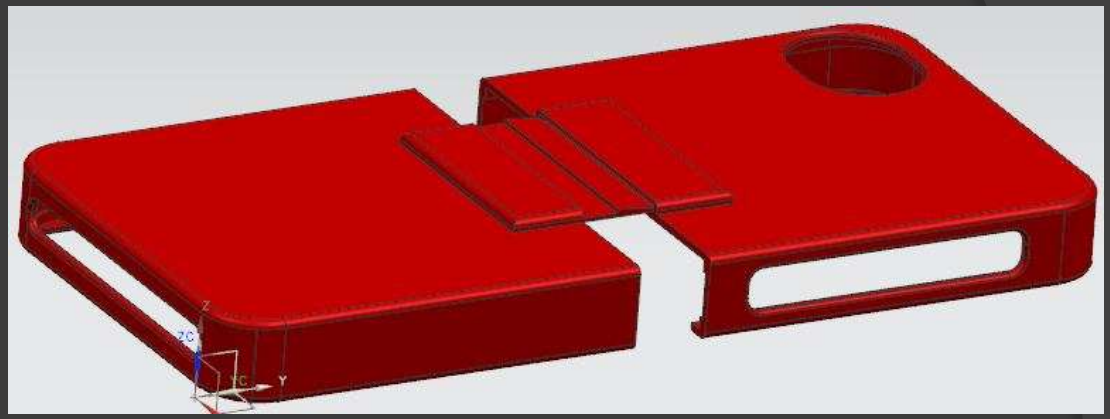
iPhone 4s Case Family

- Goals:
  - Design a family of cases to appeal to the widest consumer base possible
  - Test and analyze models using FEA for structural and thermal loadings
- Designs:
  - “One Time Use”
  - The Wave – For the fashion sensitive
  - The Fortress – Ultimate Protection
  - iFin – Heat Dissapation
  - “X” Factor – Increased Strength

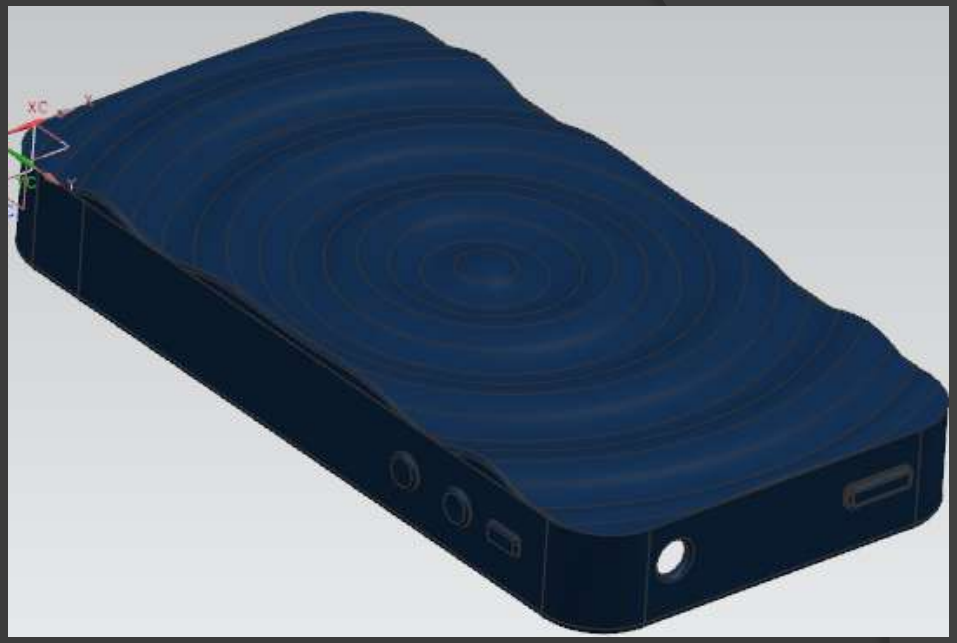
The iPhone 4s Model

“One Time Use”



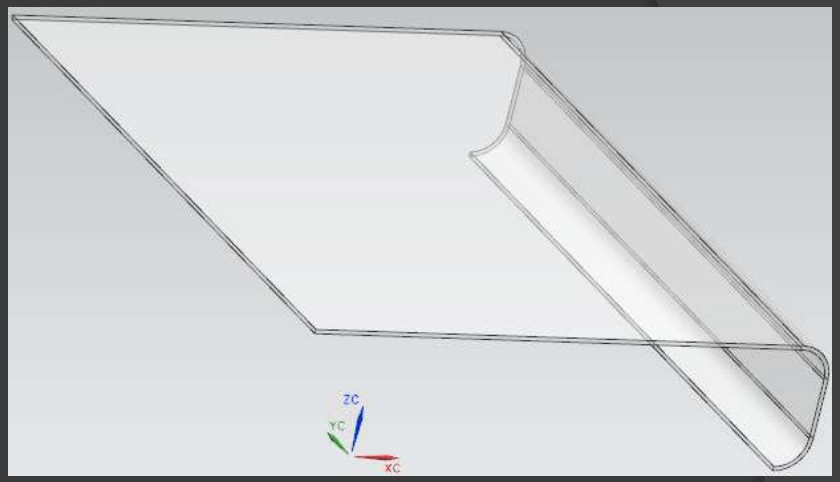


The Wave

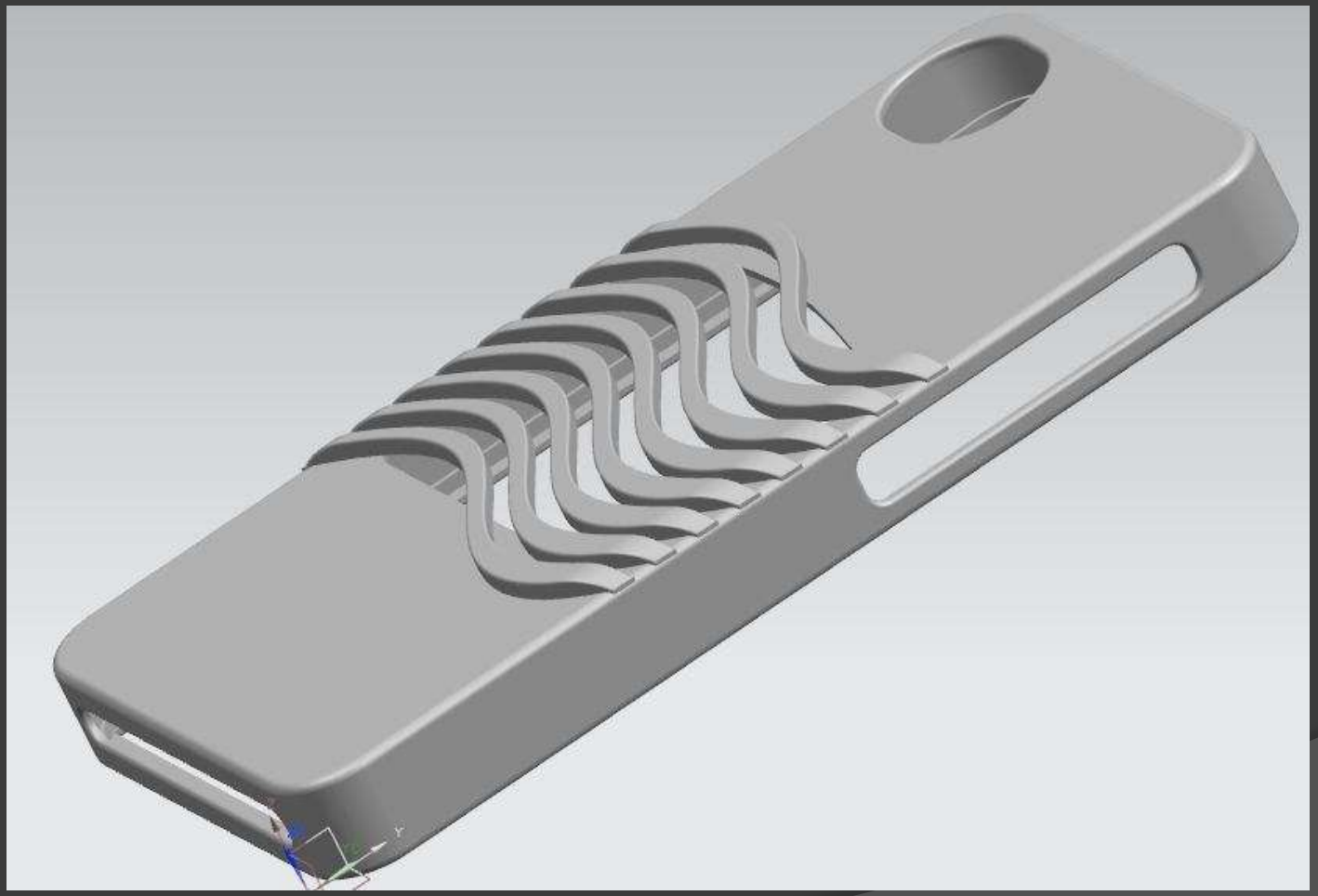


The Fortress

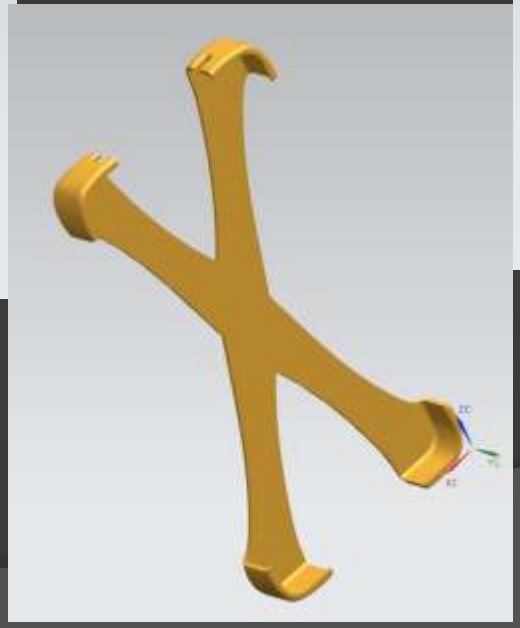
The Fortress in Detail



iFin



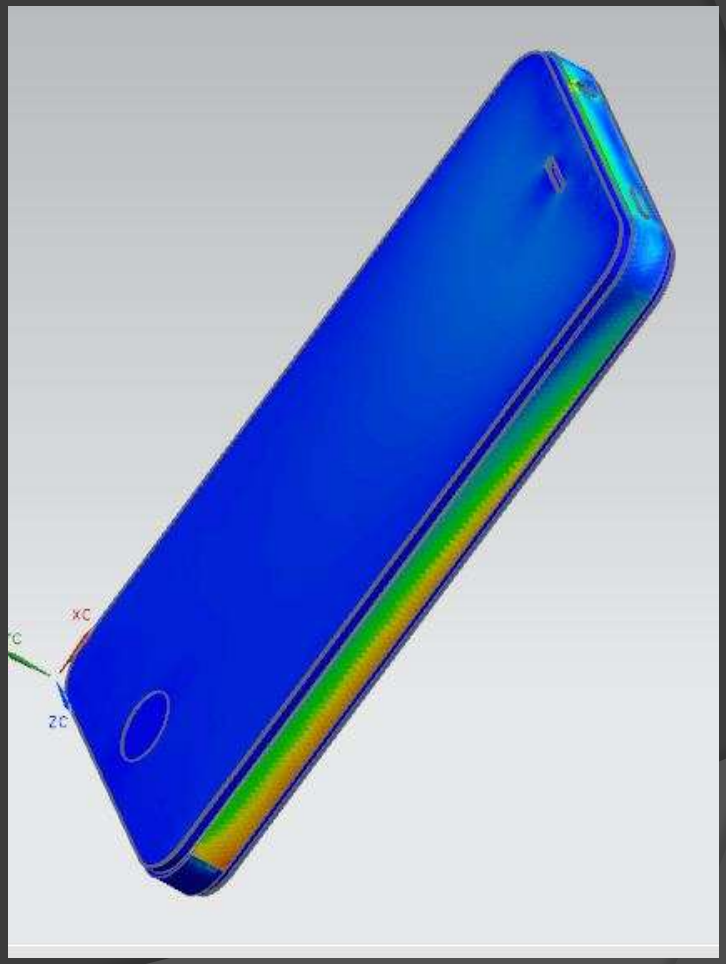
The X-Factor



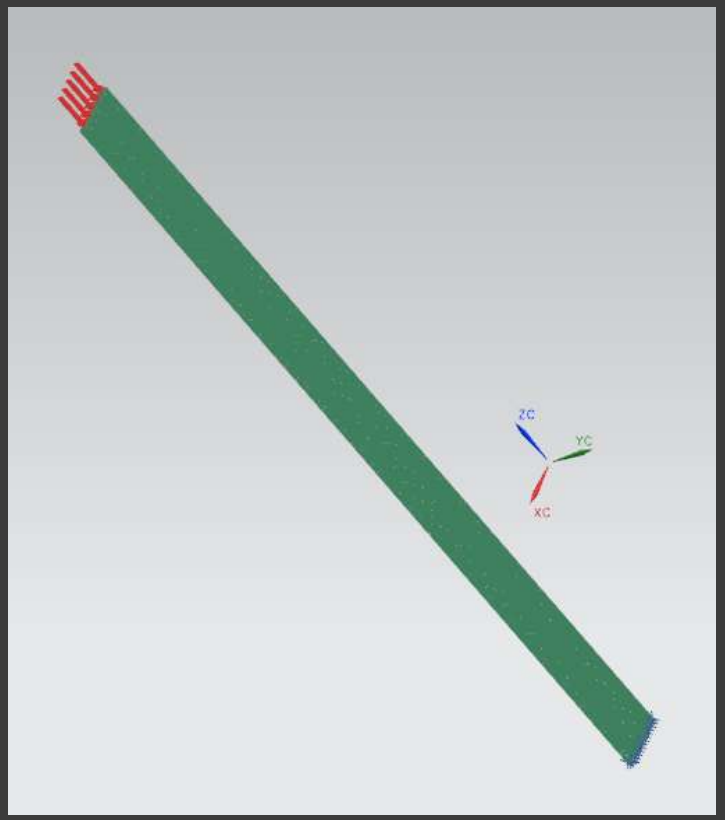
Potential Case Materials

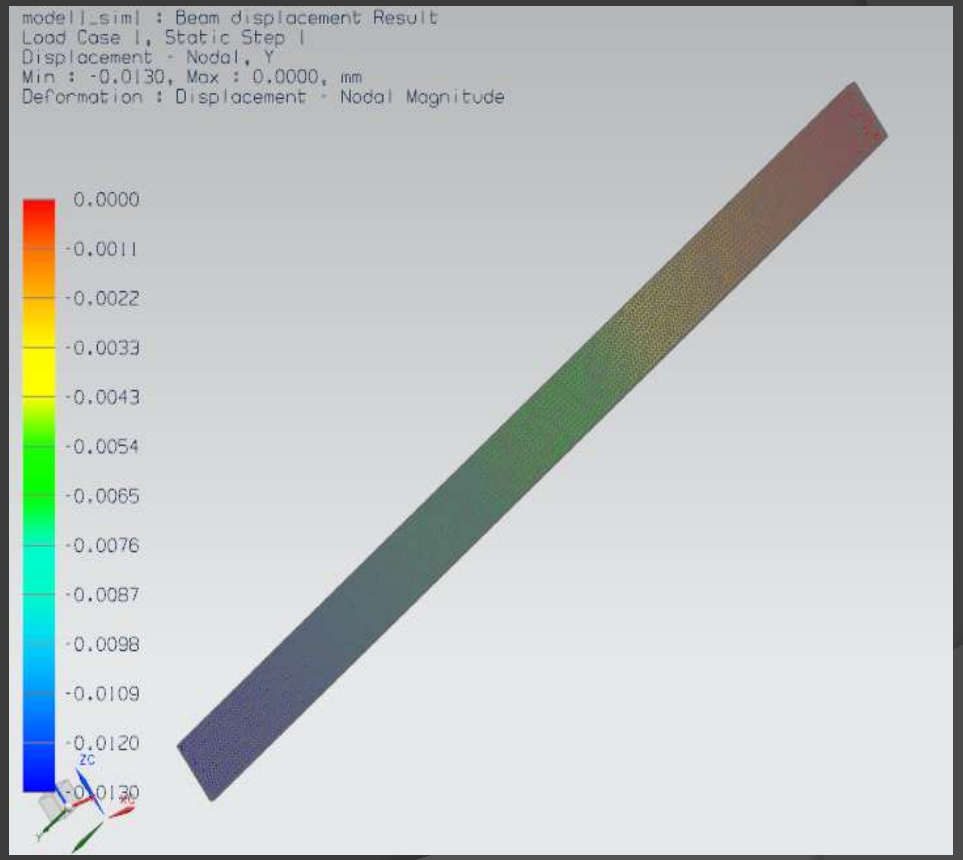
- Polycarbonate for tight protection
- Silicone for stylish grip
- Hybrid Polycarbonate/Silicone
- Rubber - Tumble resistant
- Aluminum – increases signal strength
- Carbon Fiber – Lightweight and strong

iPhone FEA



iPhone FEA Verification - Dropping

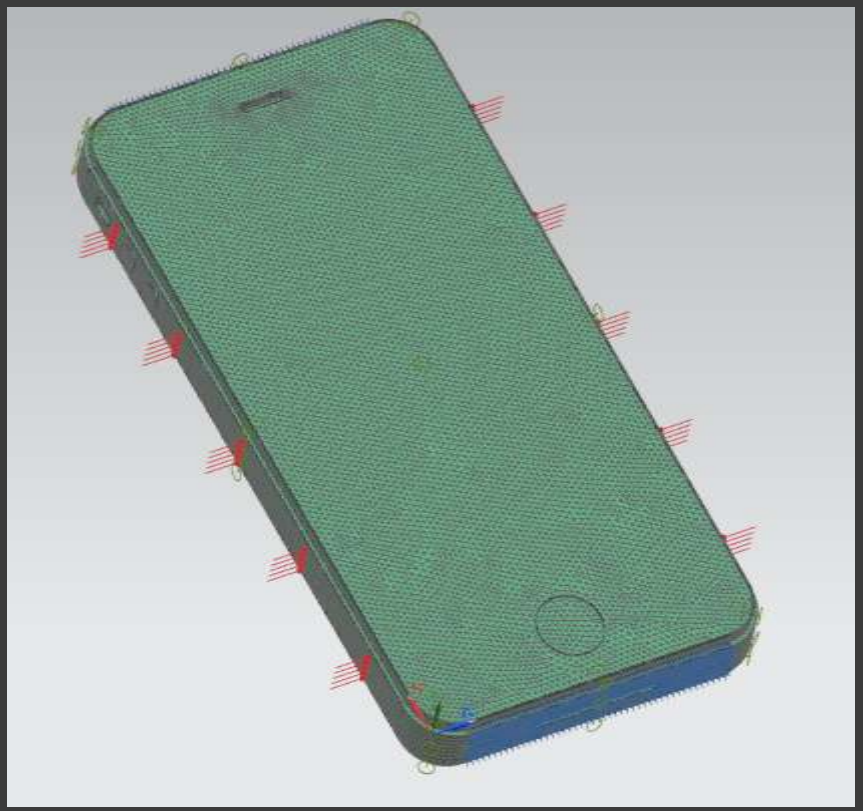


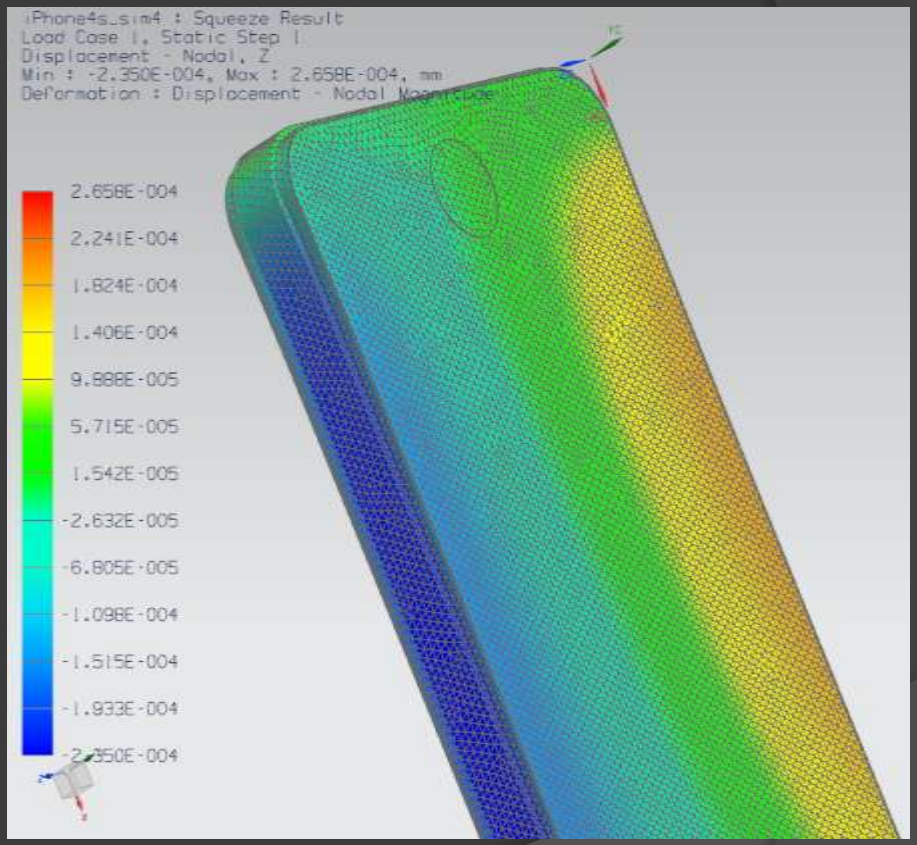


$$\begin{bmatrix} F \\ 100 \end{bmatrix} = \begin{bmatrix} k & -k \\ -k & k \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \end{bmatrix}$$

$$d_2 = 0.0132\,mm$$

iPhone FEA Verification - Squeezing





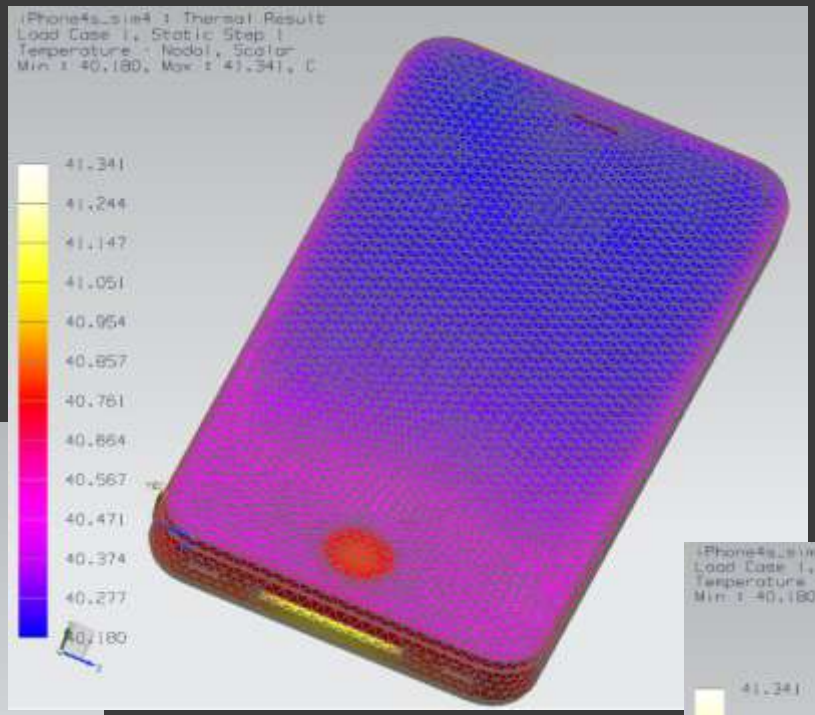
$$\begin{bmatrix} F \\ 0 \\ 50 \end{bmatrix} = \begin{bmatrix} k_1 & -k_1 & 0 \\ -k_1 & k_1 + k_2 & -k_2 \\ 0 & -k_2 & k_2 \end{bmatrix} \begin{bmatrix} 0 \\ d_2 \\ d_3 \end{bmatrix}$$

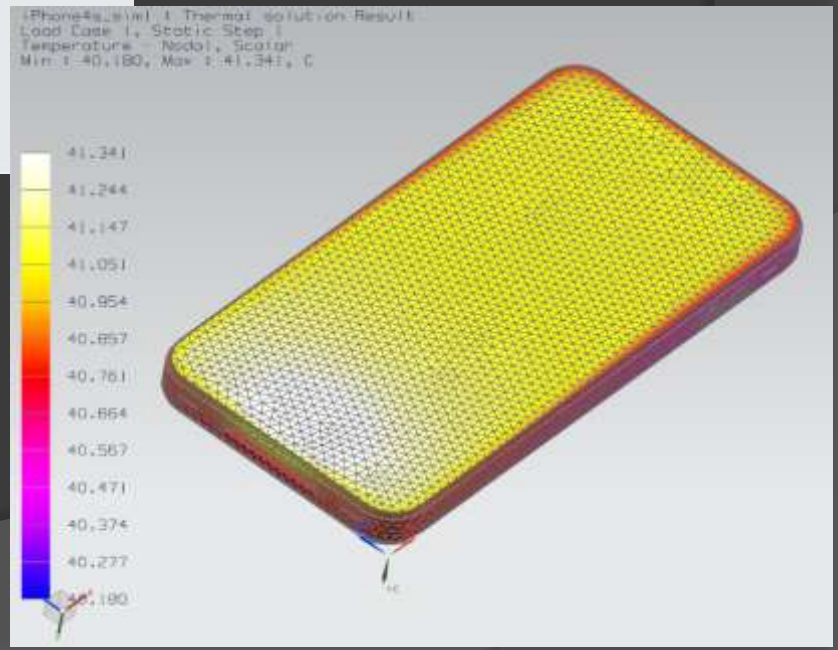
$$d_3 = 5.32 \times 10^{-4}\ mm$$

iPhone FEA Verification – Heat Flux

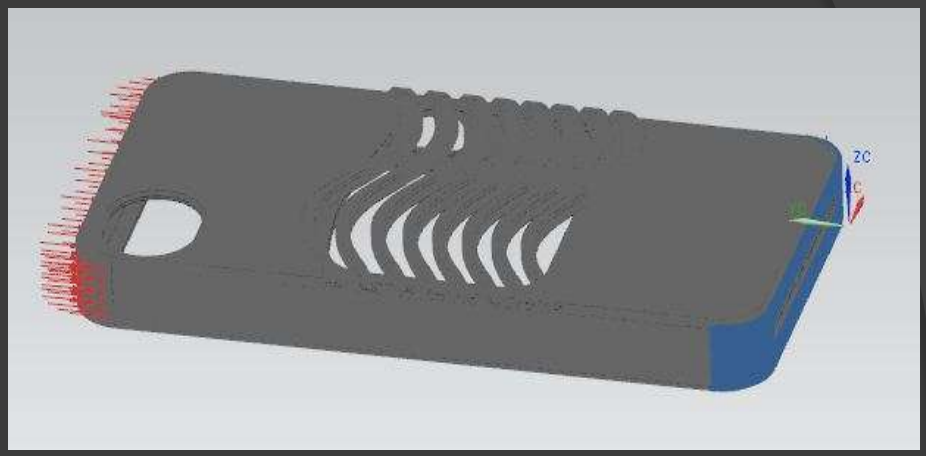
$$Q = \Delta T \times R$$

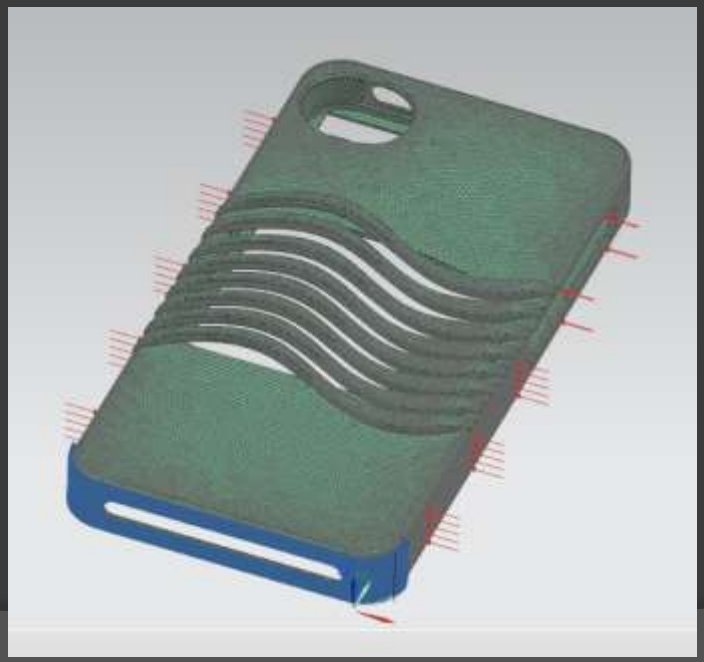
$$\Delta T = 3℃$$

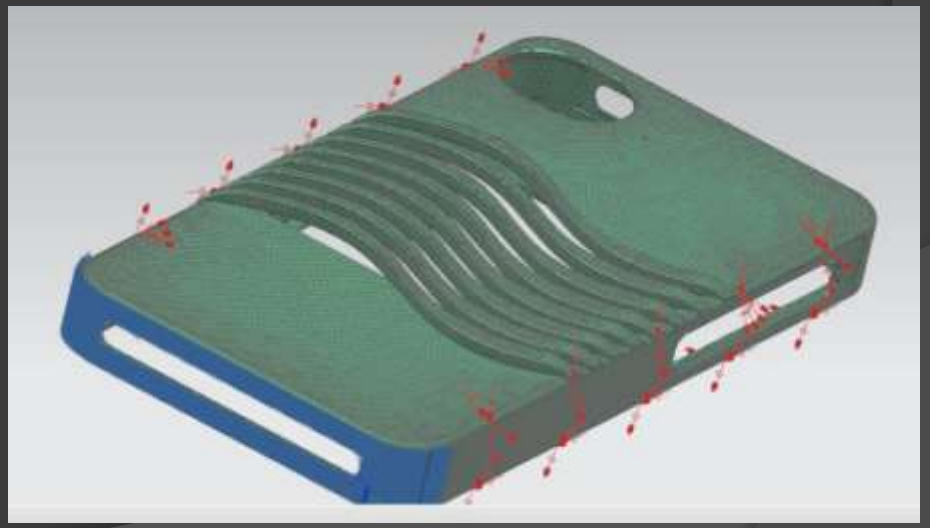




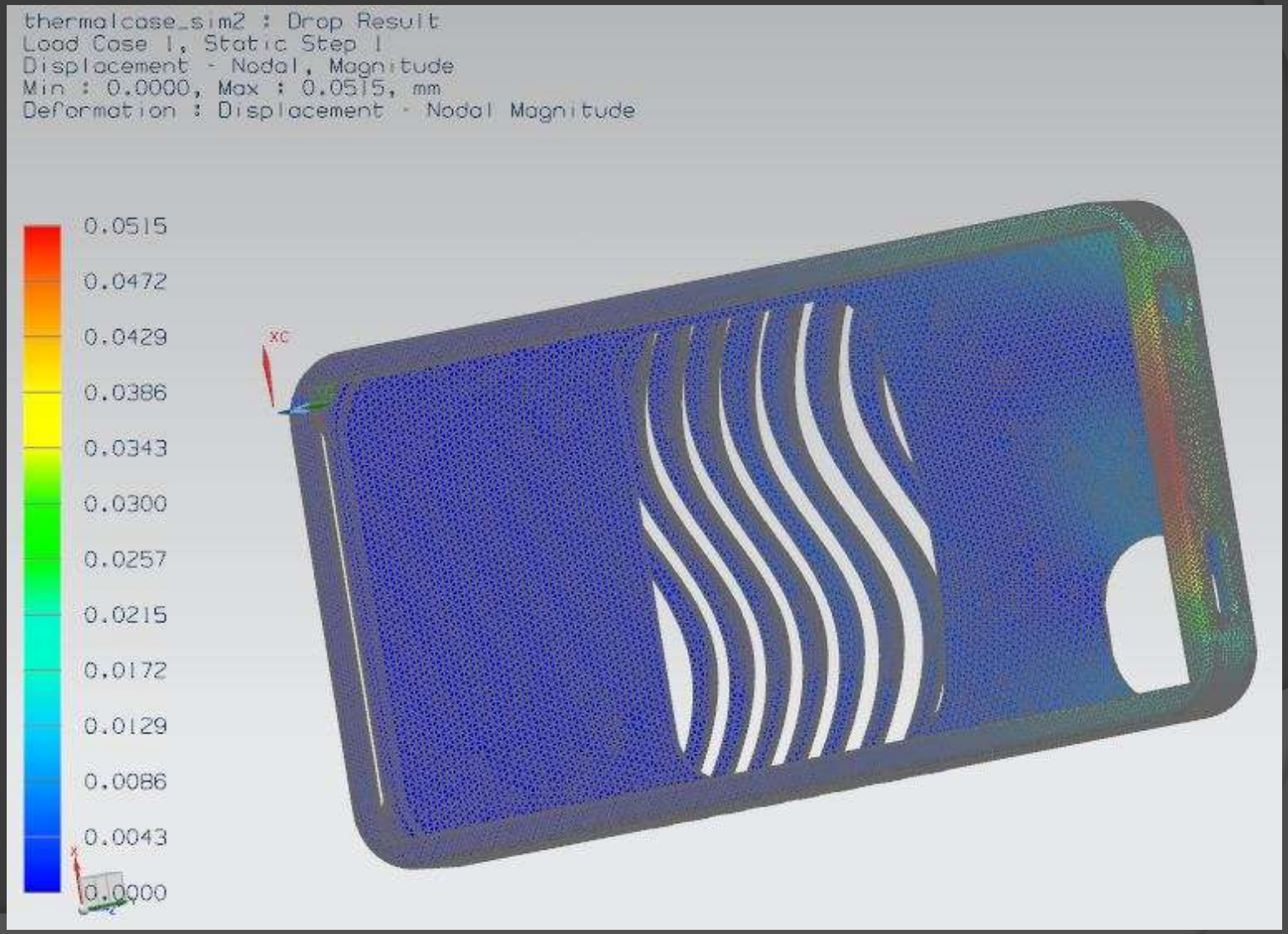
Case FEA



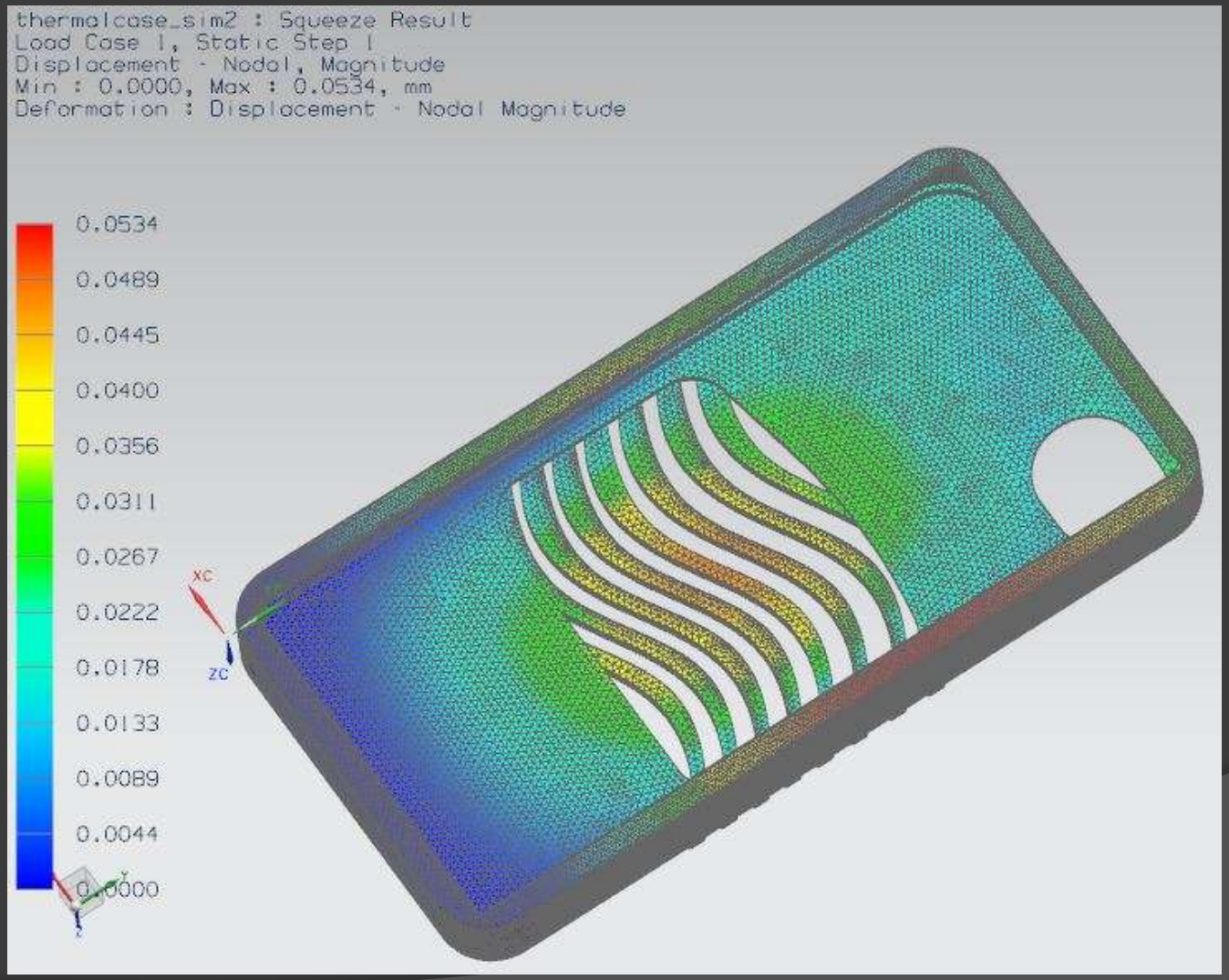




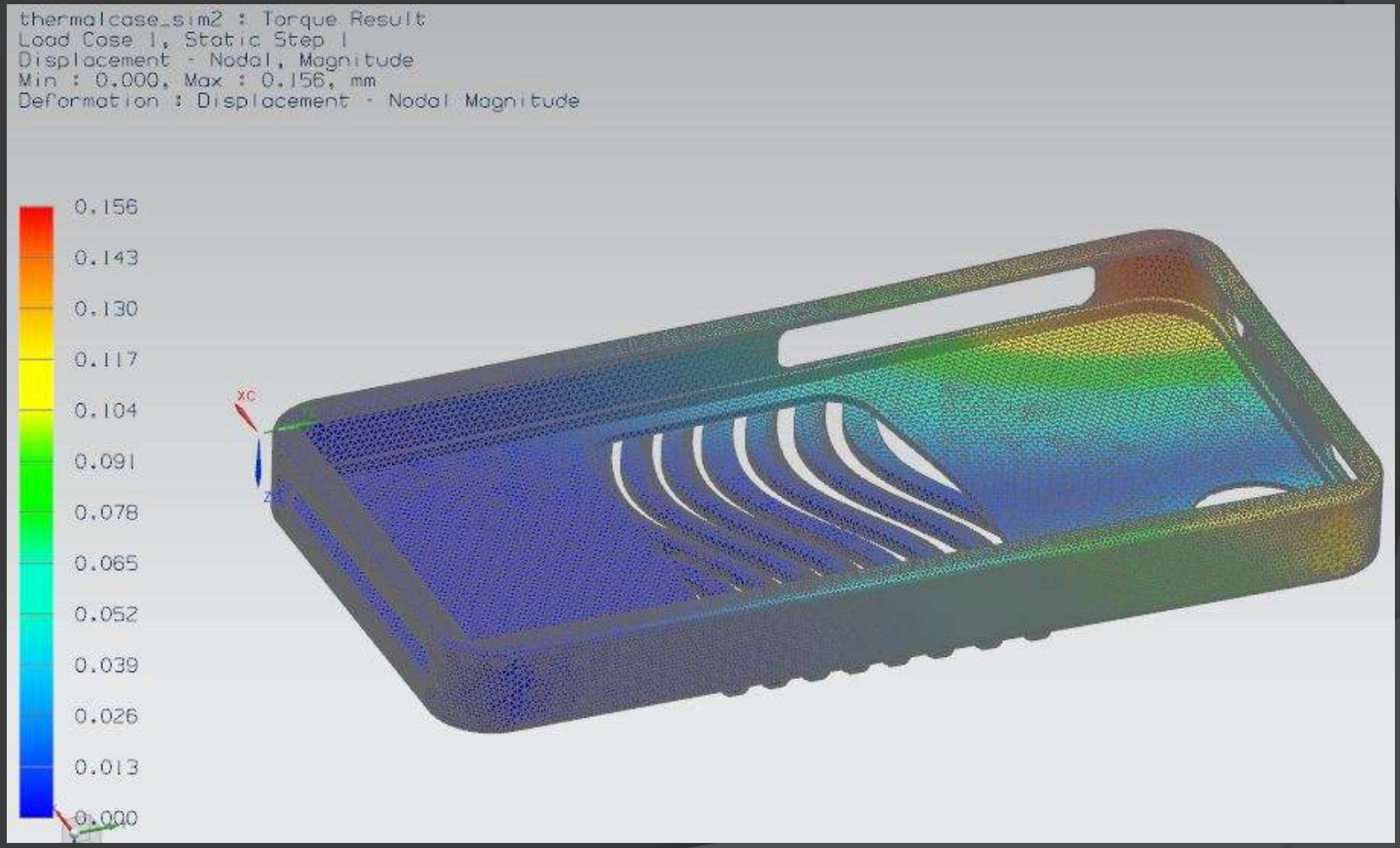
Case FEA - Dropping



Case FEA - Squeezing



Case FEA - Torque



Future Work

- Continue structrual FEA on all cases
- More thermal analysis
- Build prototypes
  - 3-D Printing of cases
- Testing of prototypes under actual loads to verify the FEA
- Marketing Analysis

- Questions?